The Future of Biology

FSA

Article

Productivity and Berries Quality of 'Superior' Grapevines as Affected by Spraying Algae Extract

Heba F.S. Ibrahim, Ali H. Ali* and Mahmoud Y.M.

Department of Horticulture, Faculty of Agriculture, Minia University, Egypt

*Corresponding author: ali.sayed1@mu.edu.eg

Abstract: The present investigation was done during 2021 and 2022 seasons on thirty vines uniform in vigor 'Superior Seedless' grapevines, grown under Matay district conditions El-Minia Governorate, Egypt, where the soil texture was loamy clay. The effect of three concentrations of algae extracts (0.25, 0.50 and 0.75 g/L) as well as its frequencies of application (once, twice and thrice) were examined. The obtained data shows that, spraying 'Superior Seedless' grapevines with algae extract at different concentrations and frequencies of application play an important and beneficial role in enhancing berries setting %, yield and berries physical and chemical properties. Meanwhile, spraying the vines three times with algae extract at 0.75 g/L present the best results in this concern. However, the most studied characters don't varied significantly as a result of increasing the concentration (from 0.50 to 0.75 g/L) and the frequencies of application (from two to three times). Then, for improving 'Superior Seedless' productivity and berry physical and chemical properties in heavy soils under this experiment or resembling conditions it may be recommended to spraying Superior Seedless grapevines with algae extract at 0.50 g/L two times yearly.

Key words: Superior Seedless grapevines, algae extracts, yield, fruit quality.

Future Science Association

Available online free at
www.futurejournals.org

Print ISSN: 2572-3006

Online ISSN: 2572-3111

DOI:
10.37229/fsa.fjb.2024.08.20

Received: 10 June 2024
Accepted: 5 August 2024
Published: 20 August 2024

Publisher's Note: FA stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

Grape (*Vitis vinifera L.*) considered as one of most important fruit crop on earth, it considers as one of the major horticulture crops throughout the world. However, it is one of the most important botanical Genus of Family *Vitaceae*. It cultivated for produces table grape or fine wine, juice and raisins **(Kanellis & Roubelakis 1993 and Doring *et al.*, 2015)**. It is well known that grapevines have a great adaptability and thrives in wide range of climatic and soil conditions **(Delas 2000, Reynier 2000, Srinivasan & Mmullins 2001 and Sluys 2006)**. Grapes also have a high nutritional value due to their higher content of sugars, vitamins, minerals especially potassium, amino acids, organic acids and plant pigments **(Coombe & Dry 1992, Kanellis & Roubelakis 1993 and Reynier 2000)**. In Egypt, grape considered as one of the most

important commercial and favorite fruit. It occupies the third position preceded by citrus and mangoes fruit crops.

Superior grapevine is one of the most popular seedless grapevines cultivar successfully grown under Egyptian conditions. This cultivar ripens early in the first week of June and sometimes in the last week of May when it grown in new reclamation sandy lands. Then, due to its early ripening it has a great opportunity for export to foreign markets **(Saad 2014)**. However, in Minia region it faces some problems such as poor yield and pour coloration berries which in turn negatively affect marketing of such grapevine cv. Therefore, some trials were made for finding out the nontraditional methods for overcoming such problems and at the same time protecting our environment from pollution.

Green regulations are driving the development of eco-friendly strategies. Bio-stimulating such as algae extract have an important role in this regard **(Sabir *et al.*, 2014, Omar *et al.*, 2017, Abou-Zaid & Eissa 2019 and Zarraonaindia *et al.*, 2023)**. Agriculture sector is more interested in using natural sources (such algae extract) in horticulture as bio-stimulant agent for the nutrient formation of the foods **(Battacharyya *et al.*, 2015 and Zarraonaindia *et al.*, 2023)**. Nowadays, there is a widespread use of the natural compounds in order to improving the predictability and fruit quality of grapevine. One of the most abandoned compounds of plant stimulating is algae extract. Algae extract which spread use in horticulture not only contains vitamins but also vitamins which may owe their origin to bacteria which attach them to sea plants, in particular vitamin B12. Vitamins known to be present in the algae extract include vitamin C (ascorbic acid), vitamin A is not present in precursor (beta-carotene), as well as fucoxanthin which may also be the precursor of Vitamin A. B group vitamins present are B1 (thiamine), B2 (riboflavin), B12, as well as pantothenic acid and folic acid. Vitamin E (toco-pherol), vitamin K, and other growth-promoting substances, also found in algae extract at considerable concentration. **(Colavita *et al.*, 2011, Zamani *et al.*, 2013, Ganapathy & Sivakumar 2014, Venkata *et al.*, 2015 and Zarraonaindia *et al.*, 2023)**.

The main objective of this study was elucidating the effect of different concentrations (0.25, 0.50 and 0.75 g/L) and frequencies of application (once, twice and third) of algae extract on yield and berries quality of 'Superior Seedless' grapevine, grown under El-Minia Governorate conditions in loamy clay soil conditions.

2. Materials and Methods

The present investigation was done during two consecutive seasons 2021 and 2022 on thirty vines uniform in vigor 'Superior Seedless' grapevines, grown in private vineyard located in Ibowan village Matay district El-Minia Governorate – Egypt. The orchard soil texture is loamy clay and well drained. The selected vines were planted at 2 X 3 meters apart. Cane pruning system was followed and the winter pruning has been conducted at the second week of December in both experimental seasons. Gable shape supporting system was conducted in the vineyard orchard. Surface irrigation system by using Nile water was adopted. The selected vines are subjected to the recommended horticulture practices that were commonly applied in vineyard orchards.

2.1. Plant material

The selected 'Superior' grapevines were 14 years old at the start of the current investigation. The selected vines were free of diseases, uniform in vigor and size and regular in productivity. The vine load was adjusted to 72 eyes per vine (6 fruiting cans × 10 eyes plus 6 renewal spurs × 2 eyes). Surface irrigation system using Nile river water was followed in this vineyard.

2.2. Soil characters

The orchard soil, where the present experiment carried out, is loamy clay soil (table 1). A composite sample was collected in the orchard soil and subjected to Physicochemical analysis according to the procedures outlined by **Chapman & Partt (1965)** and **Wilde *et al.*, (1985)**, so, the obtained results are illustrated in Table (1).

Table (1). Physicochemical analysis of experimental orchard soil

Constituents	Values
Particle size distribution:	
Sand %	11.0
Silt %	22.5
Clay %	68.5
Texture	Loamy Clay
pH(1:2.5 extract)	8.05
EC (1 :2.5 extract) (dsm^{-1}) 1 cm / 25ºC.	1.03
O.M. %	1.88
$CaCO_3$ %	2.55
Total N %	0.10
Available P (Olsen, ppm)	2.22
Available K (ammonium acetate, ppm)	400

2.3. Experimental work

Three concentrations (0.25 g/L, 0.50 g/L and 0.75 g/L) and three frequencies of applications (one, two and three times) were examined on 'Superior Seedless' grapevine, during the present study. Then, this study included the following teen treatments from algae extracted concentrations and frequencies of application: (T1) Control, 0.0 g/L algae extract, (T2) 0.25 g/L algae extract, one time, (T3) 0.25 g/L algae extract, two times, (T4) 0.25 g/L algae extract, three times, (T5) 0.50 g/L algae extract, one time, (T6) 0.50 g/L algae extract, two times, (T7) 0.50 g/L algae extract, three times, (T8) 0.75 g/L algae extract, one time, (T9) 0.75 g/L algae extract, two times and (T10) 0.75g/L algae extract three times.

Each treatment was replicated three times, one vine per each. Wetting agent was added to all solutions of Algae extract at 0.1%. Chemical analyses of brown algae extract which used in this study are shown in table (2), according to **Gomez & Gomez (1984)**.

Table (2). The chemical analysis of brown algae extract used in the current study

Compound	Concentration
Organic Matter	42 ~ 57%
Total Nitrogen	0.6 ~ 1.6%
Phosphorus (P_2O_5)	7 %
Potassium	17 ~ 20%
Mg	0.49 ~ 0.62%
Ca	0.44 ~ 1.70 %
Fe	0.15 ~ 0.30 %
Alginc acid	10 – 14%
Soluble in water	100%
Appearance	Flake or Particle

2.4. Experimental design and statistical analysis

The treatments were arranged in a randomized complete block design (RCBD), each treatment was replicated tree times, and one vine per each was used. The obtained results were tabulated and subjected to statistical analysis, using analysis of variance (ANOVA) by MSTATC Program. Comparisons between the means were made by LSD at p= 0.05, according to and **Snedecor & Cochran (1990)**.

2.5. Determination of yield and berries physicochemical properties

At harvesting, the clusters number per vine was counted and recorded. The yield (kg) per vine was estimated as a result of multiplying the number of cluster per vine X average cluster weight (g). Four clusters were taken random from each vine for estimate the following physical and chemical parameters:

Cluster attributes: Average cluster length (cm), average cluster width (cm) and average cluster weight (g) by using 0.01 sensitivity balance.

Berry physical attributes: Average berry weight (g) by using 0.01 sensitivity balance, berry dimensions (longitudinal and equatorial 'cm') were measured by using vernier caliper.

Berry chemical attributes: Percentage of total soluble solids in the juice by using handy refractometer, percentage of total acidity (expressed as grams tartaric acid per 100 grams of juice), by titration against 0.1 NaOH in presence of phenolphthalein as an indicator **(A.O.A.C., 2000)**, percentage of reducing sugar by using Lane and Eynone volumetric method **(Rangana, 1990)**.

3. Results and Discussion

3.1. Effect of spraying algae extract on berries setting %

Data present in Table (3) shows the effect of different concentrations (0.25, 0.50 and 0.75 g/L) and frequencies of application (once, twice and thrice) of algae extract on the percentage of berry settings of 'Superior Seedless' grapevines during 2021 and 2022 seasons. It is clear from this table that, subjected 'Superior Seedless' grapevines to spraying algae extract once, twice or thrice at 0.25, 0.50 and 0.75 g/L significantly was responsible for enhancing the percentage of berries setting % relative to the control treatment.

A gradual and significant promotion on berries settings % parallel to increasing the concentrations and frequencies of application of algae extract was showed. However, increasing concentrations of algae extract from 0.50 to 0.75 g/L had non-significant promotion on berries setting % neither in the first season nor in the second.

It's clear from the same table that 'Superior Seedless' grapevines sprayed three times with algae extract at 0.75 g/L produced the highest berries setting % (11.2 and 11.1 %) followed by those received two sprays with algae extract at 0.50 g/L (10.7 and 10.8 %), during 2021 and 2022 seasons respectively. On the other side, un-treated vines (control) present the lowest berries setting (8.2 and 8.0 %); these data were true during the two experimental seasons respectively.

3.2. Effect of spraying algae extract on yield and its component

Data concerning the effect of different concentrations and frequencies of algae extract on yield expressed in weight and number of clusters/vine as well as average weight of cluster of 'Superior Seedless' grapevines during 2021 and 2022 seasons are presented in Table (3). It is noticed from the obtained data that, spraying the vines once, twice and thrice with algae extract at 0.25 g/L, 0.50 g/L and 0.75 g/L significantly was accompanied to improving yield (kg/vine) as well as cluster weight (g) relative to the control treatment. It is worth to mention that, during the first season the clusters number/vine don't varied significantly. However, remarkable and significant increase in yield (kg/vine) was observed especial with all algae extract concentrations and frequencies in same season, may due to the significant decreased of shot berries and increase in the cluster weight (g).

Regardless the algae extract concentrations and frequencies of application, non-significant differences were observed in the first season on cluster numbers/vine. This is may be logic, since fruiting bud were internally formed in the preceding year. This increment can be explained by the important role of algae extract in enhancing the cluster weight. The obtained results declared that, during the two experiment seasons, the vines received the highest concentration (0.75 g/L) of algae extract three times yearly present the highest cluster weight (367 and 372 g), yield (10.3 and 11.7 kg/vine), as well as the cluster number per vine during the second season (31.4). On the opposite side, untreated vines present

the lowest cluster weight (330 and 335 g), yield (8.6 and 8.9 kg/vine), and cluster number per vine (26.1 and 26.6), in both experimental seasons.

Algae extract can be a powerful and environmental friendly approach to improve 'Superior Seedless' grapevine cluster weight (g) and yield (kg/vine) by increasing fruits cell number early in the growth season and fruit cell volume during berry growth period **(Samuels *et al.*, 2022 and Zarraonaindia *et al.*, 2023)**. In the same context, in the present investigation spraying algae extract clearly and significantly enhancing berries setting % during the two season, that surly reflected on increased the yield (kg/vine). The obtained results are in harmony with those obtained by **Rombola *et al.*, (2001), Durand *et al.* (2004), Abdel-Mawgoud (2010), Arun *et al.* (2014), Omar (2014), Saad (2014), Ali & Mohamed (2016), Samuels *et al.* (2022) and Zarraonaindia *et al.* (2023)**.

Table (3). Effect of spraying algae extract at different concentrations and frequencies on berry setting %, No. of cluster / vine, cluster weight and yield (kg/vine) of 'Superior Seedless' grapevines, during 2021 and 2022 seasons

Treatments	Berries setting%		No. of clusters		Cluster weight (g)		Yield (kg)	
	2021	2022	2021	2022	2021	2022	2021	2022
Control	8.2	8.0	26.1	26.6	330.0	335.0	8.6	8.9
0.25 g/L Algae extract once	9.0	8.9	27.0	28.0	347.0	350.0	9.4	9.8
0.25 g/L Algae extract twice	9.7	9.6	28.0	29.1	354.0	358.0	9.9	10.4
0.25 g/L Algae extract thrice	10.1	9.9	28.2	29.8	358.0	363.0	10.2	10.8
0.50 g/L Algae extract once	9.6	9.7	28.0	29.4	353.0	357.0	9.9	10.4
0.50 g/L Algae extract twice	10.3	10.4	28.6	30.0	360.0	363.0	10.3	10.9
0.50 g/L Algae extract thrice	10.7	10.7	28.9	30.0	363.0	366.0	10.5	11.2
0.75 g/L Algae extract once	10.1	10.1	28.0	29.8	357.0	362.0	10.0	11.8
0.75 g/L Algae extract twice	10.7	10.8	28.9	30.7	363.0	368.0	10.5	11.3
0.75 g/L Algae extract thrice	11.2	11.1	29.4	31.4	367.0	372.0	10.3	11.7
New LSD at 5%	**0.06**	**0.05**	**NS**	**0.8**	**5.0**	**6.0**	**0.4**	**0.5**

3.3. Effect of spraying algae extract on cluster physical properties

3.3.1. Effect on shot berries%

Data concerning the effect of different concentrations and frequencies of algae extract on shot berries % of 'Superior Seedless' grapevines grown in loamy clay under El-Minia Governorate conditions during 2021 and 2022 seasons are illustrated in Table (4). It is noticed from the obtained data that spraying 'Superior Seedless' grapevine once, twice and thrice with algae extract at 0.25 g/L, 0.50 g/L and 0.75 g/L significantly was accompanied with decreasing the shot berries % relative to the control treatment. Furthermore, the decline on such this undesirable phenomenon was in proportional to increasing the frequencies of application of algae extract from one to three times. However, the percentage of shot berries per cluster was significantly unaffected by increasing frequencies of application from two to three as well as increasing the concentrations from 0.25 to 0.75 g/L.

Furthermore, remarkable and significant decrement in shot berries % was observed especial with the highest Algae extract concentration (0.75 g/L) and highest frequencies of application (three times). So, this treatment presents the lowest shot berries (6.7 ad 6.4 %) in their clusters followed by those received two sprays at 0.50 g/L, during the two seasons respectively. On the opposite side, untreated vines present the highest shot berries in their cluster (10.1 and 10.3 %), in both experimental seasons respectively.

This role of algae extract in reducing this undesirable character (shot berries %), might be explained by its higher contents in plant growth regulators such as GA_3 and citokinens as well as its higher effect in amino acids and mineral elements **(Benjama & Masniyom 2012, Abd El-Hakem 2018 and Samuels *et al.*, 2022)**. Furthermore, algae extracts are often classified as plant bio-stimulants **(Khan *et al.*, 2012 and Correia *et al.*, 2015)**, generally it thought to contain higher amounts of macro- and micronutrient, amino acids, vitamins, cytokinins, auxins, abscisic acid **(Reitz & Trumble, 1996, Durand *et al.*, 2003, Stirk *et al.*, 2004, Gad El-Karim & Abd El-Rahman 2013 and Samuels *et al.*, 2022)**. Thus, might be lead to justifies this remarkable decreased of shot berries%.

3.3.2. Effect on cluster dimensions

Data concerning the effect of different algae extract concentrations and frequencies of application on cluster dimensions of 'Superior Seedless' grapevines (length and diameter), during 2021 and 2022 seasons showed that, spraying 'Superior Seedless' grapevine once, twice and three times with algae extract at 0.25 g/L, 0.50 0.75 g/L significantly increased the cluster length and diameter (cm) rather than the control treatment, in the both experimental seasons. It is clear from the obtained data that the enhancement of cluster length and diameter was gradual and parallel to gradual increasing of algae extract concentration and frequencies. However, the vines received three sprays with the highest concentration (0.75 g/L) present the highest cluster length (21.2 and 22.1 cm) and diameter (13.8 and 13.1 cm), during the two seasons respectively. Contrary, untreated vines present the lowest cluster length (19.0 and 19.3 cm) and diameter (11.7 and 11.5 cm), respectively.

The promotion effect of algae extract on improving 'Superior Seedless' grapevine cluster height and diameter can be explained by its higher content of amino acids, anti-oxidants such as vitamins and phynols compounds **(Saad 2014, Ali & Mohamed 2016, Samuels *et al.*, 2022 and Zarraonaindia *et al.*, 2023)** noted that algae has been widely reported and studied, and has been proven to show various useful of plant biological activity, which could be useful for improving and enhancing cluster aspects. Moreover, algae extract rich in phosphates compounds such as adenosine-di and -tri phosphate (ADP and ATP). Thus can be explained the favorable obvious effect on 'Superior Seedless' cluster length and diameter.

3.4. Effect of spraying algae extract on berry physical properties

3.4.1. Berry weight and dimensions

Data concerning the effect of algae extract at different concentrations and frequencies of application on berry weight and dimensions of 'Superior Seedless' grapevines grown under El-Minia Governorate conditions during 2021 and 2022 seasons are shown in Table (4). It is clear from this table that all examined concentrations and frequencies of applications were capable to enhancing berry weight and dimensions significantly during the two experimental seasons. There was a gradual promotion on berry weight, berry length and berry diameter parallel with increasing algae extract concentrations (from 0.25 g/L to 0.75 g/L) and frequencies of application (from one to three times). While, increasing the concentrations from 0.50 to 0.75 g/L and its frequencies of application (from two to three times) had non-significant promotion, during the two examined characters (berry weight and berry dimensions).

The maximum values of berry weight (4.34 & 4.59 g) berry length (2.1 & 2.13 cm) and berry diameter (2.23 & 2.23 cm), were produced from the vines received three sprays with algae extract at 0.75 g/L followed be those received two sprays at 0.50 g/L, these findings were true during the two seasons respectively. On the contrary, the minimized berry weight (3.55 & 3.70 g), berry length (1.82

& 1.90 cm) and berry diameter (1.95 & 1.90 cm), were produced from untreated vines (control), in both experimental seasons respectively.

The effect of algae extract as a bio-stimulant compound at different concentrations and frequencies of application on berry weight and dimensions can be explained by the various functions of algae extract in fruit growth and development, such as; activates some important enzymes, proteins put up, photosynthesis and photosynthesis pigments as well as stimulate mineral uptake and translocation such as potassium and boron **(Saad, 2014, Ali & Mohamed 2016, Samuels *et al.*, 2022 and Zarraonaindia *et al.*, 2023)**. However, various studies such as **Zarraonaindia *et al.*, (2023)** noticed that algae extract application has a beneficial effect, and more prominent when plants were subjected to multiple stresses including biotic and abiotic stresses. Generally, the obtained results are accordance with those obtained by **Abdel-Mawgoud (2010), Arun *et al.*, (2014), Osman (2015), Saad (2014), Ali & Mohamed (2016) and Samuels *et al.*, (2022)**.

3.4.2. Juice %

It is obvious from the obtained data that subjected 'Superior Seedless' grapevines to once, twice and thrice sprays with algae extract (at 0.25, 0.50 and 0.75 g/L) was significantly accompanied with enhancing the percentage of berries juice. It's clear that the results were taken similar trend during the both experimental seasons. The increment in juice % was gradual and parallel to increasing the concentration of algae extract and its frequencies of application. However, it's clear from the obtained data that the trees received three sprays with algae extract at highest concentration (0.75 g/L) produced the highest juice percentages (77.3 and 77.2%) followed by those received two sprays with algae extract at 0.75 g/L (77 and 77.1 %) during the two experimental seasons respectively. In the contrary, untreated vines produced the minimized juice percentages in their berries (75.0 and 75.3 %), during both seasons respectively. it is worth to mention that, increasing the concentration.

Table (4). Effect of spraying algae extract at different concentrations and frequencies on berry physical properties of 'Superior Seedless' grapevines, during 2021 and 2022 seasons

Treatments	Berry weight (g)		Berry length (cm)		Berry diameter (cm)		Juice (%)	
	2021	2022	2021	2022	2021	2022	2021	2022
Control	3.55	3.70	1.82	1.90	1.95	1.90	75.0	75.3
0.25 g/L Algae extract once	3.75	3.93	1.90	1.97	2.03	1.99	75.7	75.9
0.25 g/L Algae extract twice	3.92	4.11	1.96	2.03	2.09	2.06	76.2	76.4
0.25 g/L Algae extract thrice	4.05	4.26	2.00	2.06	2.12	2.10	76.4	76.7
0.50 g/L Algae extract once	3.93	4.12	1.97	2.02	2.09	2.07	76.3	76.4
0.50 g/L Algae extract twice	4.10	4.29	2.03	2.08	2.15	2.14	76.8	77.0
0.50 g/L Algae extract thrice	4.22	4.44	2.06	2.11	2.19	2.19	77.1	77.2
0.75 g/L Algae extract once	4.07	4.28	2.00	2.05	2.12	2.12	76.6	76.7
0.75 g/L Algae extract twice	4.24	4.45	2.07	2.10	2.19	2.19	77.0	77.1
0.75 g/L Algae extract thrice	4.34	4.59	2.10	2.13	2.23	2.23	77.3	77.2
New LSD at 5%	**0.15**	**0.17**	**0.05**	**0.04**	**0.05**	**0.06**	**0.4**	**0.4**

3.5. Effect of spraying algae extract on berry chemical properties

3.5.1. Berry TSS% and reducing sugars%

It is clear from the obtained data illustrated in Table (5) that, treating 'Superior Seedless' grapevine once, twice and thrice with algae extract (at 0.25, 0.50 and 0.75 g/L) significantly was followed by enhancing TSS% and reducing sugars% comparison to control treatment (untreated vines), during the two experimental seasons. This promotion of the two estimated characters (TSS and reducing sugars) was parallel to increasing algae extract concentrations from 0.25 g/L to 0.75 g/L as well as its frequencies of application from one to three times, in both experimental seasons. However, non-significant differences in TSS% and reducing sugars% were observed between the two higher frequencies of applications, during the two experimental seasons.

The obtained data showed that the vines received three sprays with algae extract at higher concentration (0.75 g/L) produced the highest TSS% (20.5 and 20.2 %) and reducing sugars contents (18.5 and 18.9 %) in their berries followed by those received algae extract at 0.75 g/L two times (20.1 & 20.0 % for TSS and 18.2 & 18.5% for reducing sugars), during the two seasons respectively. On the opposite side, untreated vines produced the lowest TSS % (17.8 & 17.9 %) and reducing sugars (16.1 & 16.3 %), during 2021 and 2022 seasons respectively.

3.5.2. Berry total acidity % and TSS / acidity ratio

Data obtained during the two experimental seasons as shown in Table (5) displayed that, all treatments of algae extract caused a significant decrement in total acidity % and increment in TSS/acidity ratio in the berries of 'Superior Seedless' grapevine compared to untreated vines. It is clear from this table that, the gradual increasing of both concentrations and frequencies of application of algae extract was parallel to reducing the total acidity % in berries juice and increasing the TSS/ acidity ratio relative to the control treatment (untreated trees) in both experimental seasons. The obtained data also showed that non-significant differences were observed between the two higher concentration (0.50 g/L and 0.75 g/L) and two higher frequencies of application (two and three), these findings were true in both experimental seasons. It is clear that, the lowest total acidity values (0.613 % & 0.618 %) and highest TSS/acidity ratio (33.4 and 32.7) were obtained from the vines received three sprays of algae extract at 0.75 g/L, followed by those received 0.50 g/L (0.626 & 0.632 % for total acidity and 32.1 and 31.6 for TSS/total acidity). Contrary, untreated vines produced the highest total acidity values (0.700 & 0.705 %) and lowest TSS/total acidity ratio (25.4 and 25.4), in both experimental seasons respectively.

Spraying algae extract regulated the carbohydrate metabolism of fruit trees. The hydrolysis of sucrose by invertase regulates the levels of some plant hormones and vitamins, compounds are found in algae extract composition **(Cook *et al.*, 2018, Belal *et al.*, 2023 and Sirbu *et al.*, 2023)**. Based on the previous studies, these information confirms the relationship between algae extract and berries chemical concentration **(Cataldo *et al.*, 2022 and Kara *et al.*, 2022)** throughout increasing the intensity of photosynes and enzymes activate, can lead to accumulation of reducing sugar and non-reducing sugars may be due to increased synthesis and translocation of more photosynthetic assimilates to the fruits and breakdown of starch during ripening stage.

The obtained results are in harmony with those obtained by **Kok *et al.*, (2010)** on 'Trakya Ilkeren' grapevines grown under Turkey conditions, **Saad (2014)** on 'Flame Seedless' grapevines grown under Minia governorate conditions – Egypt, **Frioni *et al.*, (2018)** on 'Sangiovese' grapevines *cv.* grown in Italy and 'Pinot Noir' *cv.* and 'Cabernet Franc' grown under Michigan condition – USA, **El-Sese *et al.*, (2020)** on 'Bez-El-Anza', 'Thompson Seedless' and 'Red Roomy' grapevines cultivars grown under Assiut Governorat, Egypt and **Topuz *et al.*, (2022)** on 'Tarsus Beyazi' grapevine grown under Mersin conditions, Turkey.

Table (5). Effect of spraying algae extract at different concentrations and frequencies on berry chemical properties of 'Superior Seedless' grapevines, during 2021 and 2022 seasons

Treatments	TSS (%)		Total acidity (%)		Total sugars (%)	
	2021	2022	2021	2022	2021	2022
Control	17.8	17.9	0.700	0.705	16.1	16.3
0.25 g/L Algae extract once	18.6	18.6	0.675	0.680	16.9	17.0
0.25 g/L Algae extract twice	19.2	19.3	0.657	0.663	17.5	17.6
0.25 g/L Algae extract thrice	19.6	19.6	0.644	0.648	17.8	18.0
0.50 g/L Algae extract once	19.3	19.2	0.658	0.662	17.4	17.5
0.50 g/L Algae extract twice	19.8	19.7	0.640	0.646	18.0	18.2
0.50 g/L Algae extract thrice	20.1	19.9	0.626	0.631	18.2	18.5
0.75 g/L Algae extract once	19.6	19.5	0.645	0.647	17.7	17.9
0.75 g/L Algae extract twice	20.1	20.0	0.626	0.632	18.2	18.5
0.75 g/L Algae extract thrice	20.5	20.2	0.613	0.618	18.5	18.9
New LSD at 5%	**0.5**	**0.4**	**0.015**	**0.016**	**0.4**	**0.5**

4. Conclusion

It is clear from the obtained results that spraying 'Superior Seedless' grapevines grown in loamy clay soil under El-Minia Governorate conditions with algae extract at different concentrations and frequencies of application play an important and beneficial role in enhancing berries setting %, yield and berries physical and chemical properties. Meanwhile, spraying the vines three times with algae extract at 0.75 g/L present the best results in this concern. However, the most studied characters non-varied significantly as a result of increasing the concentration (from 0.50 to 0.75 g/L) and the frequencies of application (from two to three times). Then, for improving the productivity and berry physical and chemical properties of 'Superior Seedless' grapevines grown heavy soils under this experiment or resembling conditions it may be recommended to spraying Superior Seedless grapevines with algae extract at 0.75 g/L two times yearly.

References

Abd El-Hakem, A. A. M. (2018). Effect of spraying seaweed extract on fruiting of Superior grapevines. M.Sc. Hort. Depart. Fac. of Agric. Minia Univ.

Abdel-Mawgoud, A.M.R.; Tantaway, A.S.; Hafez, M. and Habib, H.A.M. (2010). Seaweed extract improves growth, yield and quality of different watermelon hybrids. Res. J. of Agric. & Bio. Sci., 6: 161-168.

Abou-Zaid, E.A.A. and Eissa, M.A. (2019). Thompson Seedless grapevines growth and quality as affected by glutamic acid, vitamin B and Algae. J of Sci. & Plant Nutr., 2019, 19: 725 – 733.

Ali, H. A. and Mohamed, M.A.K. (2016). Effect of fruiting spur length and spraying seaweed extract on yield and berries quality of Early Sweet grapevines. Assiut J. Agric. Sci., (47) No, (6-2), 504 - 517.

A.O.A.C., Association of official Analytical Chemists (2000). Official Methods for Analysis 16th Ed. AOAC, Washington, D.C.

Arun, D.; Gayathri, P.K.; Chandran, M. and Yuvaraj, D. (2014). Studies on Effect of Seaweed Extracts on Crop Plants and Microbes. International J. Chem-Tech. Res., 6 (9): 4235-4240.

Battcharyya, D. ; Babgohari, M. Z.; Rathor, P.; Prithirraj, B. (2015). Seaweed extracts as bio-stimulants in horticulture. Scientia Horticulturae, Vol. 196, November 2015, Pages 39-48.

Belal, B.E.; El-kenawy, M.A.; El-Mogy, S. and Omar, A.S.M. (2023). Influence of Arbuscular Mycorrhizal Fungi, Seaweed Extract and Nano-Zinc Oxide Particles on Vegetative Growth, Yield and Clusters Quality of 'Early Sweet' Grapevines. Egypt. J. Hort., 50 (1): 1-16.

Benjama, O. and Masniyom, P. (2012). Biochemical composition and physicochemical properties of two red seaweeds (Gracilaria fisheri and G. tenuistipitata) from the pattani bay in southern Thailand. Songklanakarin J. Sci. Technol., 34 (2): 223-230.

Chapman, V.J. and Chapman, D.J. (1980). Seaweed and their uses. 3th Ed. Chapman and Hall, New York. 334P.

Colavita, G.M.; Spera, N.; Blackall, V. and Sepulveda, G.M. (2011). Effect of seaweed extraction on pear fruits quality and yield. Proc. XI Intern. pear sym. Eds. Acta Horti. (ISHS), 909: 601-607.

Cook J, Zhang J, Norrie J, Blal B, Cheng Z (2018). Sea-weed extract (Stella Maris) activates innate immune responses in Arabidopsis thaliana and protects host against bacterial pathogens. Marine drugs, 16 (7): 221-229.

Coombe, B.G. and Dry, R.R. (1992). Viticulture. Vol. 2 practices *VIII* pp. 376.

Correia, S.; Oliveira, L.; Queirós, F.; Ribeiro, C; Ferreira, L.; Luzio, A.; Silva, A.P. and Goncalves, B. (2015). Preharvest application of seaweed based biostimulant reduced cherry (*Prunus avium* L.) cracking. Procedia Environ. Sci., 29: 251 – 252.

Delas, J. (2000). Fertilisation de la vigne. Edition Féret- Bordeaux, France.

Doring, J.; Frisch, M.; Tittman, S.; Stoll, M. and Kauer, R. (2015). Growth, yield and fruit quality of grapevines under organic and biodynamic management. Plos One, 2015; 10 (10): 74-81.

Durand, K.; Murat, O. and Metin T. (2004). Seaweed extracts improve copper uptake of grapevine. Acta Agriculturae Scandinavica, Section B - Soil & Plant Sci., 54 (4): 215-221.

El-Sese, A.M.; Mohamed, A.K.A.; Abou-Zaid , E.A.A. and Abd-El-Ghany, A.M.M. (2020). Impact of foliar application with seaweed extract, amino acids and vitamins on yield and berry quality of some Grapevine cultivars. J. Fac. Agric., Assiut Univ., 2 (1): 73-84.

Frioni, T.; Sabbatini, P.; Tombesi, S.; Norrie, J.; Poni, S.; Gatti, M. and Palliotti, A. (2018). Effects of a biostimulant derived from the brown seaweed *Ascophyllum nodosum* on ripening dynamics and fruit quality of grapevines. Scientia Horticulturae, 232: 97-106.

Gad El-Kareem, M.R. and Abd El-Rahman, M.M.A (2013). Response of Ruby seedless grapevines to foliar application of seaweed extract, salicylic acid and Roselle extract. Hort. Sci. J. of Suez Canal Univ., 1: 299-303.

Ganapathy, G. S. and Sivakumar, K. (2014). Influence of seaweed extract as an organic fertilizer on the growth and yield of Arachis hypogea L. and their elemental composition using SEA-Energy dispersive spectroscopic analysis. Asian J. of Reproduction 2014, 3(1): 18-22.

Gomez, K. H. and Gomez, A. A. (1984). Statistical Procedures for Agriculture Research John Willy and Sons, Inc., New York.

Kanellis, A.K. and Roubelakis, K.A. (1993). Bio.chemistry of fruit ripening. Edited by G. Seymour, J. Taylor and G. Tucker. Published by Chapman & Hall, London, pp 189-219.

Khan, A.S.; Ahmad, B.; Jaskani, M.J.; Ahmad, R.; Malik, A. (2012). Foliar Application of Mixture of Amino Acids and Seaweed (*Ascophylum nodosum*) Extract Improve Growth and Physico- chemical Properties of Grapes. Inter. J. of Agric. & Bio., 14 (3): 1560-853014.

Kok, D.; Bal, E.; Celik, S.; Ozer, C. and Karauz, A. (2010). The influence of different seaweed doses on table quality characteristics of cv. Trakya Ilkeren (*Vitis vinifera* L.). Bulgarian J. of Agric. Sci., 16 (4): 429-435.

Mooney, P.A. and Staden, V.J. (1986). Algae and cytokinins. J of Plant Physiology, 123: 1–21.

Omar, A.E.D (2014). Use of seaweed extract as a promising post-harvest treatment on Washington Navel orange (*Citrus sinensis* Osbeck). J. of Biological Agric. & Horti. Inter. Journal, Vol 30, 2014 - Issue 3. 71-79.

Osman, M.M.M. (2015). Response of Superior grapevines grown under hot climates to rest breakages. M.Sc. Fac. of Agric. Minia Univ. Egypt.

Ranganna, S. (1990). Manual analysis of fruit and vegetable products. Edition Tata Mc Grow-Hill Publishing Company, New Delhi India, 634 P.

Reitz, S.R. and Trumble, J.T. (1996). Effect of cytokinins-containing seaweed extract on *phaseolus lunatus* L.: Influence of nutrient availability and apex removal. J of Bot. Mar., 39: 33-38.

Reynier, A. (2000). Manuel de viticulture, Guide technique du viticulteur. 8e Edition TEC&D0C-Paris France.

Rombola, A.D.; Malaguti, D.; Gerin, M.; Simoni, G.; Tagliavini, M.; Marangoni, B. (2001). Effect of seaweed extract-based leaf sprays on the growth, yield and fruit quality of apple trees. International Symposiom on Foliar Nutrition of Perennial Fruit Plants.

Saad, S. (2014). Influence of Reducing Mineral Nitrogen Fertilizer Partially by Using Plant Compost Enriched with *Spirulina Plantensis* Algae on Fruiting of Flame Seedless Grapevines. M.Sc. Thesis, Fac. of Agriculture Minia University, Egypt.

Sabir, A.; Yazar, K.; Sabir, F.; Kara, Z.; Yazici M. A.; Goksu, N. (2014). Vine growth, yield, berry quality attributes and leaf nutrient content of grapevines as influenced by seaweed extract (*Ascophyllum nodosum*) and nanosize fertilizer pulverizations.

Samuels, L.J.; Setati, M.E. and Blancquaert, E.H. (2022). Towards a better understanding of the potential benefits of seaweed based biostimulants in *Vitis vinifera* L. cultivars. Plants 11, 348. doi: 10.3390/plants11030348.

Sluys, S.L. (2006). Climatic influences on the grape: A study of viticulture in the Waipara Basin. M.Sc. Thesis Univ. of Canterbury, New Zealand.

Snedecor, G.W. and Cochran, W.G. (1990). Statistical Methods, 7th Ed. Iowa State Univ. Press Ames. pp 80-100.

Srinivasan, C. and Mullins, M. (2001). Physiology of flowering in the grapevine. Am. J. Enol. Vitic., 32: 47–63.

Stirk, W.A.; Arthur, G.D.; Lourens, A.F.; Novak, O.; Strnad, M.; van Staden, J. (2004). Changes in cytokinin and auxin concentrations in seaweed concentrateswhen stored at an elevated temperature. J. of Appl. Phycol., 16: 31–39.

Topuz, T.; Keskin, N.; Kiraz, M.E. ; Tarım, G.; Topuz, F.; Ozel, N. & Kaya, O. (2022). Effect of foliar spraying of Ascophyllum nodosum extracts on grape quality of 'Tarsus Beyazi'. Erwerbs-Obstbau, 6: 1873-1879.

Venkata, R.P.; Reddy A.S. and Koteswara, R.Y. (2015). Effect of Seaweed Liquid Fertilizers on Productivity of vigna radiata L. Wiliczek. International J. Res. Chem. Environ., Vol. 5 (4), 91-94.

Wilde, S.A.; Corey, R.B.; Layer, J.G. and Voigt, G.K. (1985). Soil and plant analysis for tree culture. 3rd Ed, Oxford and New Delhi- India Publishing: 529-546.

Zamani, S.; Khorasaninejad, S.; Kashef, B. (2013). the importance role of seaweeds of some characters of plant. Inter. J. of Agriculture and Crop Sci. Vol., 5 (16), 1789-1793.

Zarraonaindia, I.; Cretazzo, E.; Mena-Petite, A.; Díez-Navajas, A.M.; Pérez-López, U.; Lacuesta, M.; Pérez-Alvarez, E.P.; Puertas, B.; Diaz, C.F.; Bertazzon, N.; Villar, E.C. (2023). Holistic understanding of the response of grapevines to foliar application of seaweed extracts. Front. Plant Sci., 1119854., 14: 1-17.